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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Assaf Govari
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Title	:	POSITION SENSING BASED ON ULTRASOUND EMISSION
Art Unit	:	3768
Examiner	:	Michael T. Rozanski

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APPEAL BRIEF

i. Real Party in Interest

Biosense Webster, Inc., a California Corporation, is the real party in interest.

ii. Related Appeals and Interferences

None.

iii. Status of Claims

Claims 1 – 29 are pending in the case. Claims 1, 14 and 19 had been amended on August 20, 2002. Claims 1 – 29 have been finally rejected on September 24, 2007 and this Appeal is taken from these claims.

iv. Status of Amendments

No Amendments have been filed after this Final Rejection dated September 24, 2007.

v. Summary of Claimed Subject Matter

As fully supported in Applicant's Specification, for example as shown in FIGS. 1–9B, Claim 1 of Applicant's invention is directed to an apparatus 20 for determining the disposition of an object 22 (catheter) relative to a reference frame, comprising at least one field generator 40, 42, 44, which generates an electromagnetic field in a vicinity of the object 22. Specification Page 11, Lines 1-8 and Lines 22-25. At least one transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A), which is fixed to the object 22 and which vibrates at a predetermined vibrational frequency and emits energy, responsive to an interaction of the electromagnetic field therewith. Specification Page 11, Lines 16-22. One or more detectors 34, 36, 38 are used in a vicinity of the object 22 which detect the energy emitted by the transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A), and generate signals in response thereto. Specification Page 12, Lines 1-24. A signal processor 30 receives and processes the detector signals to determine coordinates of the object 22, and the signal processor 30 calculates the position and/or orientation of the at least one transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A), by determining three position vector components and three components of angular orientation. Specification Page 12, Lines 20-24 and Page 15, Line 15 – Page 16, Line 13. A display 28 is also provided for displaying the position and/or orientation of the at least one transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A). Specification Page 12, Lines 20-24 and FIG. 6.

Claim 14 of Applicant's invention is directed to an apparatus 20 for determining the disposition of an object (catheter) 22 relative to a reference frame, comprising at least one field generator 40, 42, 44, which generates an electromagnetic field in a vicinity of the object 22. Specification Page 11, Lines 1-8 and Lines 22-25. A transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A) is fixed to the object 22, which emits acoustic energy responsive to the electromagnetic field. Specification Page 11, Lines 16-22. One or more detectors 34, 36, 38 are placed at known positions in a vicinity of the object 22, which detect the acoustic energy emitted by the transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A) and which generate signals in response thereto. Specification Page 12, Lines 1-24. A signal processor 30 receives and processes the detector signals to determine coordinates of the object 22, and the signal processor 30 calculates the position and/or orientation of the at least one transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A) by determining three position vector components and three components of angular orientation. Specification Page 12, Lines 20-24 and Page 15, Line 15 – Page 16, Line 13. A display 28 is also used for displaying the position and/or orientation of the at least one transducer12 (118, 120, 122) (FIGS. 2A, 2C and 3A). Specification Page 12, Lines 20-24 and FIG. 6.

Claim 19 of Applicant's invention is directed to a method for determining the disposition of an object (catheter) 22 relative to a reference frame which comprises fixing to the object 22 a transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A), which vibrates at a vibrational frequency thereof. Specification Page 11, Lines 16-22. And, generating an electromagnetic field in a vicinity of the object 22. Specification Page 11, Lines 1-8 and Lines 22-25. And, detecting energy, emitted by the transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A) responsive to an interaction of the field with the transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A), the energy having a frequency dependent on the vibrational frequency of the transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A), at one or more locations in the reference frame and generating signals responsive thereto. Specification Page 12, Lines 1-24. And, processing the signals to determine coordinates of the object 22 based on three vector components and three components of angular orientation.

Specification Page 12, Lines 20-24 and Page 15, Line 15 – Page 16, Line 13. And, displaying the position and/or orientation of the transducer 12 (118, 120, 122) (FIGS. 2A, 2C and 3A). Specification Page 12, Lines 20-24 and FIG. 6.

vi. Grounds of Rejection to be Reviewed on Appeal

1. Claims 1, 14 and 19 have been rejected under 35 U.S.C. § 102 (e) as being anticipated by U.S. Patent 6,226,547 (Lockhart et al.).

2. Claims 1-3 and 14-20 have been rejected under 35 U.S.C. § 103 (a) as being unpatentable over U.S. Patent 5,057,095 (Fabian) in view of Lockhart et al.

3. Claims 4-13 and 21-29 have been rejected under 35 U.S.C. § 103 (a) as being unpatentable over Fabian and Lockhart et al. in view of U.S. Patent 5,727,552 (Ryan).

vii. Argument

1. The rejection of Claims 1, 14 and 19 under 35 U.S.C. § 102 (e) as being anticipated by U.S. Patent 6,226,547 (Lockhart et al.) is improper and without basis and should be overruled.

Rejections under 35 USC §102 are proper only when the claimed subject matter is identically disclosed or described in the prior art. *In re Arkley*, 59 CCPA 804, 455 F. 2d 586, 587, 172 USPQ 524, 526 (1972). Thus, in order to constitute an anticipation, all material elements recited in a claim must be found in one unit of prior art. *Soundscriber Corp. v. United State*s, 360 F.2d 954,960, 148 USPQ 298, 301 (Ct. Cl. 1966).

Turning now to the prior art reference, Lockhart et al. is directed to a catheter tracking system that only uses magnetic field transducer (magnetic field sensor) 18 mounted in its catheter in conjunction with reference transducers that are magnetic field sources. Col. 4, Lines 5-8. It is important to note that the Lockhart et al. reference is limited in its

teachings to magnetic field transducer and magnetic field reference transducers only and does not in any way address using at least one transducer which vibrates at a predetermined vibrational frequency and emits energy (acoustic) responsive to an electromagnetic field such as found with the Applicant's claimed present invention. Accordingly, this material element of Applicant's claimed invention of Claims 1, 14 and 19 is completely absent from the teachings of Lockhart et al.

Thus, it is clear that Lockhart et al. fails to disclose material elements recited in Applicant's Claims 1, 14 and 19 respectively and could never anticipate these claims due to the limited teachings found in Lockhart et al., and therefore, this rejection is without basis and should be overruled.

2. The rejection of Claims 1-3 and 14-20 under 35 U.S.C. § 103 (a) as being unpatentable over U.S. Patent 5,057,095 (Fabian) in view of Lockhart et al. is improper and without basis and should be overruled.

A claimed invention is unpatentable if the differences between it and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a) (Supp. 1998); *see Graham v. John Deere Co.*, 383 U.S. 1, 14, 148 USPQ 459, 465 (1966). The ultimate determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness. *See Graham*, 383 U.S. at 17-18, 148 USPQ at 467; *Miles Labs, Inc., Inc. v. Shandon Inc.*, 997 F.2d 870, 877, 27 USPQ2d 1123, 1128 (Fed. Cir. 1993).

The invention being claimed in Claims, 1, 14 and 19 of Applicant's claimed present invention is an apparatus and method for determining the disposition of an object relative to

a reference frame which comprises at least one field generator which generates an electromagnetic field in a vicinity of the object; at least one transducer which is fixed to the object and which vibrates at a predetermined vibrational frequency and emits energy (acoustic energy) responsive to an interaction of the electromagnetic field therewith; and having one or more detectors in a vicinity of the object which detect the energy by the transducer and generate signals in response thereto; and a signal processor which receives and processes the detector signals to determine coordinates of the object wherein the signal processor calculates the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation; and a display for displaying the position and/or orientation of the at least one transducer.

Fabian discloses a surgical implement detector utilizing a resident marker 18 which is a dipole by generating a dipole field. Column 6, Lines 11-13. It is important to note that the Fabian system uses dipole forces and a location methodology for detecting basic orientations of the marker 18 only. These are three defined orientations identified as: "parallel orientation 50", "perpendicular orientation 52" and "vertical orientation 54". The limitations of the Fabian system are clearly highlighted in Column 7, Lines 2-15 where it states:

> In the parallel orientation 50, the marker length is parallel to the plane of the coils 40 and 42. The perpendicular orientation 52 exists when the marker length is perpendicular to the plane of the coils 40 and 42. A vertical orientation 54 is presented when the marker length is perpendicular to orientations 52 and 54. Referring to FIG. 5, the perpendicular orientation 52 of the marker 18 generates a strong signal in zone 62 and a weak signal in zones 60 and 64. The parallel orientation 50 of the marker 18 generates a strong signal in zones 60 and 64, and a weak signal in zone 62. In the vertical orientation 54, the marker 18 generates little or no signal in zone 62 and no significant signal in zones 60 and 64.

Thus, it is important to note that the Fabian system is entirely incapable of calculating both the position and/or orientation of the transducer by determining three position vector components and three components of angular orientation. Moreover, Fabian

lacks any disclosure, suggestion or even inference for utilizing a display in order to display the position and/or orientation of the at least one transducer.

It is also important to note that Fabian does not disclose, suggest or even infer at least one transducer which is fixed to an object and which vibrates at a predetermined vibrational frequency and emits energy (acoustic energy) responsive to an interaction of an electromagnetic field such as found with Applicant's claimed invention of Claims 1, 14 and 19.

Not only is the scope and content of this prior art reference limited in its teachings, but there are significant differences from the teachings of Fabian when compared to the novel apparatus features and method steps (as outlined above) of Applicant's claimed present invention. Therefore, one skilled in the art would not be lead by the teaching of Fabian to experiment with its resident marker system. Thus, contrary to the Examiner's assertions, Fabian is actually evidence of the non-obvious of the present invention. See *Graham*, 383 U.S. at 17-18, 148 USPQ at 467; *Miles Labs, Inc., Inc. v. Shandon Inc.*, 997 F.2d 870, 877, 27 USPQ2d 1123, 1128 (Fed. Cir. 1993).

Additionally, there is nothing in Fabian that indicates that a skilled artisan would have been motivated, where calculating both the position and/or orientation of an acoustic transducer by determining three position vector components and three components of angular orientation was required, to provide an apparatus and method for determining the disposition of an object relative to a reference frame which comprises at least one field generator which generates an electromagnetic field in a vicinity of the object; at least one transducer which is fixed to the object and which vibrates at a predetermined vibrational frequency and emits energy (acoustic energy) responsive to an interaction of the electromagnetic field therewith; and having one or more detectors in a vicinity of the object which detect the energy by the transducer and generate signals in response thereto; and a signal processor which receives and processes the detector signals to determine coordinates of the object wherein the signal processor calculates the position and/or orientation of the at least one transducer by determining three position vector components and three components

of angular orientation; and a display for displaying the position and/or orientation of the at least one transducer such as found with Applicant's claimed present invention. Fabian et al. simply does not describe nor suggest this combination. It is clear that there is no incentive in Fabian to use such a combination. Therefore, unless a Declaration under 37 C.F.R. § 1.107(b) is submitted by the Examiner to support this argument, it is not factually supported by the record and may not be the basis for a rejection under 35 U.S.C. § 103. See In re Wagner and Folkers, 152 U.S.P.Q. 552, 559 (CCPA 1967).

According to the Examiner's argument, the combination of Fabian. With Lockhart et al. in the rejection was directed toward providing motivation for modifying the structure of Fabian thereby providing a *prima facie* case of obviousness. However, neither Lockhart et al. in combination with Fabian al. render the present invention as claimed obvious.

As described previously, Lockhart et al. actually teaches a catheter tracking system that only uses magnetic field transducer (magnetic field sensor) mounted in its catheter in conjunction with reference transducers that are magnetic field sources. It is important to note that the Lockhart et al. reference is limited in its teachings to magnetic field transducer and magnetic field reference transducers only and does not in any way address using at least one transducer which vibrates at a predetermined vibrational frequency and emits energy (acoustic) responsive to an electromagnetic field such as found with the Applicant's claimed present invention.

And, there is absolutely no teaching or suggestion in this reference that at least one transducer which vibrates at a predetermined vibrational frequency and emits energy (acoustic) responsive to an electromagnetic field could ever be used such as found with the novel apparatus elements and method steps of the Applicant's claimed present invention. There are no relevant teachings in either Fabian or Lockhart et al., either alone or in combination with each other, that would ever lead one of ordinary skill in this field to arrive at the Applicant's claimed present invention of Claims 1, 14 and 19 and their dependent claims respectively.

Thus, there is not only no suggestion or disclosure in Fabian or Lockhart et al. for making the claimed present invention of Applicant's invention, but also, significant differences exist between these limited teachings and Applicant's present invention as claimed. The only suggestion to combine the apparatus features and method steps for determining the disposition of an object relative to a reference frame which comprises at least one field generator which generates an electromagnetic field in a vicinity of the object; at least one transducer which is fixed to the object and which vibrates at a predetermined vibrational frequency and emits energy (acoustic energy) responsive to an interaction of the electromagnetic field therewith; and having one or more detectors in a vicinity of the object which detect the energy by the transducer and generate signals in response thereto; and a signal processor which receives and processes the detector signals to determine coordinates of the object wherein the signal processor calculates the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation; and a display for displaying the position and/or orientation of the at least one transducer is provided by the Applicant's own Specification. Therefore, these prior art references are being improperly applied by the Examiner, using hindsight reconstruction to pick and choose elements from these references, in the face of contrary teachings in each of these references.

The PTO has the burden under section 103 of establishing a *prima facie* case of obviousness. This burden can only be satisfied by a legal conclusion based on underlying factual inquiries. See *KSR Int'l Co. v. Teleflex, Inc.,* 550 U.S.___, 82 USPQ2d 1389 (2007). Accordingly, it is clear that these references are of limited scope and content and provide teachings that are significantly different from Applicant's claimed present invention of a Claims 1-3 and 14-20.

Additionally, even applying ordinary skill and common sense in view of the teachings of Fabian and Lockhart et al., it is evident that one of ordinary skill in this field would not be able to arrive at the novel and non-obvious combination of apparatus elements and method steps as set forth in Applicant's claimed present invention. Accordingly,

Applicants respectfully submit that a *prima facie* case of obviousness has not been established by the PTO. Therefore, Applicants respectfully request that the rejection of Claims 1-3 and 14-20 be overruled.

3. The rejection of Claims 4-13 and 21-29 under 35 U.S.C. § 103 (a) as being unpatentable over Fabian and Lockhart et al. in view of U.S. Patent 5,727,552 (Ryan) is improper and without basis and should be overruled.

A claimed invention is unpatentable if the differences between it and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a) (Supp. 1998); *see Graham v. John Deere Co.*, 383 U.S. 1, 14, 148 USPQ 459, 465 (1966). The ultimate determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of non-obviousness. *See Graham*, 383 U.S. at 17-18, 148 USPQ at 467; *Miles Labs, Inc., Inc. v. Shandon Inc.*, 997 F.2d 870, 877, 27 USPQ2d 1123, 1128 (Fed. Cir. 1993).

The invention being claimed in Claims 4-13 and 21-29 of Applicant's claimed present invention is an apparatus and method for determining the disposition of an object relative to a reference frame which comprises at least one field generator which generates an electromagnetic field in a vicinity of the object; at least one transducer, wherein the at least one transducer comprises two or more transducers, which are fixed to the object and which vibrate at substantially different respective frequencies (acoustic energy) responsive to an interaction of the electromagnetic field therewith; and having one or more detectors in a vicinity of the object which detect the energy by the transducer and generate signals in response thereto; and a signal processor which receives and processes the detector signals responsive to the different frequencies to determine coordinates of the object wherein the signal processor calculates the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation, and wherein the at least one transducer comprises two or more transducers, which

vibrate at substantially different respective frequencies, and wherein the signal processor processes the detector signals responsive to the different frequencies; and a display for displaying the position and/or orientation of the at least one transducer.

Fabian discloses a surgical implement detector utilizing a resident marker 18 which is a dipole by generating a dipole field. Column 6, Lines 11-13. It is important to note that the Fabian system uses dipole forces and a location methodology for detecting basic orientations of the marker 18 only. These are three defined orientations identified as: "parallel orientation 50", "perpendicular orientation 52" and "vertical orientation 54". The limitations of the Fabian system are clearly highlighted in Column 7, Lines 2-15 where it states:

> In the parallel orientation 50, the marker length is parallel to the plane of the coils 40 and 42. The perpendicular orientation 52 exists when the marker length is perpendicular to the plane of the coils 40 and 42. A vertical orientation 54 is presented when the marker length is perpendicular to orientations 52 and 54. Referring to FIG. 5, the perpendicular orientation 52 of the marker 18 generates a strong signal in zone 62 and a weak signal in zones 60 and 64. The parallel orientation 50 of the marker 18 generates a strong signal in zones 60 and 64, and a weak signal in zone 62. In the vertical orientation 54, the marker 18 generates little or no signal in zone 62 and no significant signal in zones 60 and 64.

Thus, it is important to note that the Fabian system is entirely incapable of calculating both the position and/or orientation of the transducer by determining three position vector components and three components of angular orientation. Moreover, Fabian lacks any disclosure, suggestion or even inference for utilizing a display in order to display the position and/or orientation of the at least one transducer.

It is also important to note that Fabian does not disclose, suggest or even infer at least one transducer, which comprises two or more transducers, which are fixed to an object and which vibrate at different vibrational frequencies (acoustic energy) responsive to an interaction of an electromagnetic field such as found with Applicant's claimed invention of Claims 4-13 and 21-29.

Not only is the scope and content of this prior art reference limited in its teachings, but there are significant differences from the teachings of Fabian when compared to the novel apparatus features and method steps (as outlined above) of Applicant's claimed present invention. Therefore, one skilled in the art would not be lead by the teaching of Fabian to experiment with its resident marker system. Thus, contrary to the Examiner's assertions, Fabian is actually evidence of the non-obvious of the present invention. See *Graham*, 383 U.S. at 17-18, 148 USPQ at 467; *Miles Labs, Inc., Inc. v. Shandon Inc.*, 997 F.2d 870, 877, 27 USPQ2d 1123, 1128 (Fed. Cir. 1993).

Additionally, there is nothing in Fabian that indicates that a skilled artisan would have been motivated, where calculating both the position and/or orientation of two or more acoustic transducers (having different vibrational frequencies) by determining three position vector components and three components of angular orientation was required, to provide an apparatus and method for determining the disposition of an object relative to a reference frame which comprises at least one field generator which generates an electromagnetic field in a vicinity of the object; two or more acoustic transducers (having different vibrational frequencies) which is fixed to the object and which vibrate at a different, predetermined vibrational frequencies and emit energy (acoustic energy) responsive to an interaction of the electromagnetic field therewith; and having one or more detectors in a vicinity of the object which detect the energy by the transducer and generate signals in response thereto; and a signal processor which receives and processes the detector signals to determine coordinates of the object wherein the signal processor calculates the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation; and a display for displaying the position and/or orientation of the at least one transducer such as found with Applicant's claimed present invention. Fabian et al. simply does not describe nor suggest this combination. It is clear that there is no incentive in Fabian to use such a combination. Therefore, unless a Declaration under 37 C.F.R. § 1.107(b) is submitted by the Examiner to support this argument, it is not factually supported by the record and may not be the basis for a rejection under 35 U.S.C. § 103. See In re Wagner and Folkers, 152 U.S.P.Q. 552, 559 (CCPA 1967).

Ryan discloses a catheter and electrical lead location system utilizing a location system 20 having a loop antenna array 22 positioned outside the patient's skin 18 and an LC resonate circuit 10 in a pacing lead tip 16 which is implanted in a patient's heart. Column 4, Lines 34-67. The LC resonate circuit 10 emits a re-radiated field 32 which is picked up by the locating system antenna array 22. Column 5, Lines 5-10. The signals received from the loops of the antenna array 22 are applied to a "signal processor 34 which is referenced to a set of X, Y, Z reference plane coordinates related to the table the patient is reclining on." Column 5, Lines 17-20. It is also important to note that the location system of Ryan is only capable of determining X, Y and Z reference plane coordinates and is completely incapable of determining three components of angular orientation of the transducer.

According to the Examiner's argument, the combination of Fabian and Lockhart et al. with Ryan in the rejection was directed toward providing motivation for modifying the structure of Fabian and Lockhart et al. thereby providing a *prima facie* case of obviousness. However, neither Ryan in combination with Lockhart et al. and/or Fabian al. render the present invention as claimed obvious.

As described previously, Lockhart et al. actually teaches a catheter tracking system that only uses magnetic field transducer (magnetic field sensor) mounted in its catheter in conjunction with reference transducers that are magnetic field sources. It is important to note that the Lockhart et al. reference is limited in its teachings to magnetic field transducer and magnetic field reference transducers only and does not in any way address using two or more transducers which vibrates at different vibrational frequencies and emit energy (acoustic) responsive to an electromagnetic field such as found with the Applicant's claimed present invention.

And, there is absolutely no teaching or suggestion in this reference that two or more transducers which vibrate at different vibrational frequencies and emits energy (acoustic) responsive to an electromagnetic field could ever be used such as found with the novel apparatus elements and method steps of the Applicant's claimed present

invention. There are no relevant teachings in either Ryan, Fabian or Lockhart et al., either alone or in combination with each other, that would ever lead one of ordinary skill in this field to arrive at the Applicant's claimed present invention of Claims 4-13 and 21-29 and their dependent claims respectively.

Thus, there is not only no suggestion or disclosure in Ryan, Fabian or Lockhart et al. for making the claimed present invention of Applicant's invention, but also, significant differences exist between these limited teachings and Applicant's present invention as claimed. The only suggestion to combine the apparatus features and method steps for determining the disposition of an object relative to a reference frame which comprises at least one field generator which generates an electromagnetic field in a vicinity of the object; two or more transducers fixed to the object and which vibrate at different vibrational frequencies (acoustic energy) responsive to an interaction of the electromagnetic field therewith; and having one or more detectors in a vicinity of the object which detect the energy by the transducer and generate signals in response thereto; and a signal processor which receives and processes the detector signals to determine coordinates of the object wherein the signal processor calculates the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation; and a display for displaying the position and/or orientation of the at least one transducer is provided by the Applicant's own Specification. Therefore, these prior art references are being improperly applied by the Examiner, using hindsight reconstruction to pick and choose elements from these references, in the face of contrary teachings in each of these references.

The PTO has the burden under section 103 of establishing a *prima facie* case of obviousness. This burden can only be satisfied by a legal conclusion based on underlying factual inquiries. See *KSR Int'l Co. v. Teleflex, Inc.,* 550 U.S.___, 82 USPQ2d 1389 (2007). Accordingly, it is clear that these references are of limited scope and content and provide teachings that are significantly different from Applicant's claimed present invention of a Claims 4-13 and 21-29.

Additionally, even applying ordinary skill and common sense in view of the teachings of Ryan, Fabian and Lockhart et al., it is evident that one of ordinary skill in this field would not be able to arrive at the novel and non-obvious combination of apparatus elements and method steps as set forth in Applicant's claimed present invention. Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been established by the PTO and the Examiner's rejection is clearly in error and should be overruled. Therefore, Applicants respectfully request the overruling of the rejection of Claims 4-13 and 21-29.

Respectfully submitted,

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viii. Claims Appendix

Claim 1. (Previously Presented) Apparatus for determining the disposition of an object relative to a reference frame, comprising:

at least one field generator, which generates an electromagnetic field in a vicinity of the object;

at least one transducer, which is fixed to the object and which vibrates at a predetermined vibrational frequency and emits energy, responsive to an interaction of the electromagnetic field therewith;

one or more detectors in a vicinity of the object which detect the energy emitted by the transducer and generate signals in response thereto;

a signal processor which receives and processes the detector signals to determine coordinates of the object, the signal processor calculating the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation; and

a display for displaying the position and/or orientation of the at least one transducer.

2. (Original) Apparatus according to claim 1, wherein there is substantially no wired connection to the transducer.

3. (Original) Apparatus according to claim 1, wherein the signal processor processes the detector signals to determine a time of flight of acoustic energy indicative of a distance of the transducer from at least one known point in the reference frame.

4. (Original) Apparatus according to claim 3, wherein the at least one transducer comprises two or more transducers, which vibrate at substantially different respective frequencies, and wherein the signal processor processes the detector signals responsive to the different frequencies.

5. (Original) Apparatus according to claim 4, wherein the signal processor determines the distance from the at least one fixed point to the two or more transducers in order to determine an angular orientation of the object.

6. (Original) Apparatus according to claim 1, and comprising one or more ultrasound generators which emit ultrasound at frequencies substantially similar to the frequency of the transducer, in order to cause the transducer to vibrate.

7. (Original) Apparatus according to claim 1, wherein the one or more detectors detect a modulation of the electromagnetic field responsive to vibration of the transducer.

8. (Original) Apparatus according to claim 1, wherein the at least one field generator comprises one or more radio frequency (RF) field generators, and wherein the one or more transducers vibrate and emit ultrasound radiation responsive to the RF field.

9. (Original) Apparatus according to claim 8, wherein the one or more detectors comprise a plurality of ultrasound detectors, situated at known locations in the reference frame, which receive the ultrasound radiation emitted by the one or more transducers.

10. (Original) Apparatus according to claim 8, wherein the one or more transducers comprise a plurality of transducers having different, respective frequencies, and wherein RF field generators generate fields at different, respective frequencies, corresponding to the different frequencies of the transducers.

11. (Original) Apparatus according to claim 10, wherein the at least one transducer comprises two or more transducers which are oriented relative to the object at substantially different respective angular orientations, and wherein the signal processor

determines angular orientation coordinates of the object responsive to a difference in the energy emitted by the two or more transducers.

12. (Original) Apparatus according to claim 1, wherein the object comprises an invasive medical instrument, and wherein the signal processor determines coordinates of the instrument inside the body of a subject.

13. (Original) Apparatus according to claim 12, wherein the medical instrument comprises a probe having a physiological sensor fixed to a distal portion thereof, in proximity to the at least one transducer.

Claim 14. (Previously Presented) Apparatus for determining the disposition of an object relative to a reference frame, comprising:

at least one field generator, which generates an electromagnetic field in a vicinity of the object;

a transducer, fixed to the object, which emits acoustic energy responsive to the electromagnetic field;

one or more detectors at known positions in a vicinity of the object, which detect the acoustic energy emitted by the transducer and generate signals in response thereto;

a signal processor which receives and processes the detector signals to determine coordinates of the object, the signal processor calculating the position and/or orientation of the at least one transducer by determining three position vector components and three components of angular orientation; and

a display for displaying the position and/or orientation of the at least one transducer.

15. (Original) Apparatus according to claim 14, wherein the transducer emits the acoustic energy substantially irrespective of any acoustic irradiation of the object.

16. (Original) Apparatus according to claim 14, wherein there is substantially no wired connection to the transducer.

17. (Original) Apparatus according to claim 14, wherein the signal processor determines a time of flight of the acoustic energy from the transducer to the one or more detectors.

18. (Original) Apparatus according to claim 17, wherein the time of flight comprises a time interval between an initiation of the electromagnetic field by the at least one field generator to an initial detection of the acoustic energy by the one or more detectors.

Claim 19. (Previously Presented) A method for determining the disposition of an object relative to a reference frame, comprising:

fixing to the object a transducer, which vibrates at a vibrational frequency thereof;

generating an electromagnetic field in a vicinity of the object;

detecting energy, emitted by the transducer responsive to an interaction of the field with the transducer, the energy having a frequency dependent on the vibrational frequency of the transducer, at one or more locations in the reference frame and generating signals responsive thereto;

processing the signals to determine coordinates of the object based on three vector components and three components of angular orientation; and

displaying the position and/or orientation of the transducer.

20. (Original) A method according to claim 19, wherein processing the signals comprises determining a time of flight of acoustic energy indicative of a distance of the transducer to at least one known point in the reference frame.

21. (Original) A method according to claim 20, wherein fixing a transducer to the object comprises fixing at least two transducers to the object, which vibrate at substantially different resonant frequencies.

22. (Original) A method according to claim 21, wherein processing the signals comprises determining a distance from the at least one fixed point to each of the at least two transducers in order to determine an angular orientation of the object.

23. (Original) A method according to claim 20, and comprising generating one or more ultrasound fields, at frequencies substantially similar to the resonant frequency of the transducer, in order to cause the transducer to vibrate.

24. (Original) A method according to claim 20, wherein detecting the energy comprises detecting a modulation of the electromagnetic field responsive to vibration of the transducer.

25. (Original) A method according to claim 20, wherein generating an electromagnetic field comprises generating a radio frequency (RF) field, and wherein detecting the energy comprises detecting acoustic radiation emitted by the transducer responsive to the RF field.

26. (Original) A method according to claim 25, wherein processing the signals comprises determining, for a plurality of known locations in the reference frame, a time of flight to each of the locations of the ultrasound radiation emitted by the transducer.

27. (Original) A method according to claim 26, wherein fixing a transducer to the object comprises fixing two or more transducers to the object at substantially different respective angular orientations, each of which vibrates at a substantially different respective resonant frequency, and

wherein generating an RF field comprises generating a field comprising frequency components corresponding to the respective resonant frequencies of the two or more transducers, and

wherein processing the signals comprises comparing signals generated responsive to the acoustic radiation detected at the different frequencies to determine an angular orientation of the object.

28. (Original) A method according to claim 19, wherein determining the disposition of an object comprises determining the disposition of an invasive medical instrument.

29. (Original) A method according to claim 28, wherein determining the disposition of the invasive medical instrument comprises determining the disposition of an invasive medical instrument with a physiological sensor fixed to a distal portion thereof, in proximity to the transducer.

ix. Evidence Appendix

Not Applicable.

x. Related Proceedings Appendix

Not Applicable.